Silver Lake 2007 Aquatic Vegetation Management Plan Update

Kosciusko County, Indiana

http://129.79.145.7/arcims/statewide%5Fmxd/viewer.htm

Prepared for:

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Executive Summary

Approximately 30 combined acres of Silver Lake and North Little Lakes were chemically treated with Aquathol K on April 27, 2007. This treatment was part of an early season treatment program designed to reduce the curly leaf pondweed population in Silver Lake. Curly leaf pondweed (CLP) is found throughout Silver Lake. The entire littoral zone of Silver Lake (24-27 acres) was treated, as well as the littoral zone of North Little Lake. Silver Lake has now been treated for 3 years, while North Little Lake has been treated for 2 years. These treatments are not expected to eliminate curly leaf pondweed in Silver Lake but should help to prevent its spread and help beneficial native plants compete with the invader.

Ten acres of North Little lake were also treated with 2, 4-D on June 19, 2007 for the control of Eurasian watermilfoil (EWM). Eurasian Watermilfoil is found in only moderate levels in North Little Lake, and the 2, 4-D treatments are designed to prevent its spread.

Two Tier II aquatic vegetation surveys were conducted on Silver Lake in 2007. The first survey was conducted on April 27, 2007, just prior to treatment. The second survey was conducted on July 25, 2007. The purpose of these surveys was to document any changes in the plant community from the 2006 surveys, and to monitor the lake's curly leaf pondweed and Eurasian watermilfoil populations, along with the native plant community.

Curly leaf pondweed was found in low abundance in Silver Lake in 2007 with a site frequency of 8.0% in both surveys. Site frequency of CLP in North Little Lake was higher, at 20% in spring and 30% in fall. Normally curly leaf pondweed abundance decreases from spring to fall. However, in order to receive LARE funding a pre-treatment vegetation survey must be performed on the lake. Early season Aquathol treatments are most effective on young actively growing plants. Since the spring vegetation survey is conducted prior to the Aquathol treatments, curly leaf pondweed plants are very young and very small which results in an under-representation of true curly leaf abundance. This is likely the reason for the increase in CLP site frequency seen in North Little Lake.

The current management strategy will continue in 2008. Approximately 30 acres will be treated with Aquathol K for CLP control in early spring. Ten acres in North Little Lake will be treated later in the growing season with 2, 4-D for the control of Eurasian watermilfoil. Coontail, the most abundant plant in Silver Lake, will not be treated with LARE funding. Coontail treatments may be permitted but must be privately funded. Private treatments of coontail may be beneficial in areas around docks and piers to improve utility of the lake. A late season Tier II survey should be conducted to monitor both native and invasive plant populations. A CLP turion survey will not be conducted in 2008, but may be conducted in 2009 or 2010 to determine the amount of CLP turions left in the sediment in Silver Lake. Cost estimates for 2008 are included on the following page.

2008 Cost Estimates:

*All cost figures are estimates only. All prices are subject to change pending 2008 chemical pricing.

1. Chemically treat areas infested by curly leaf pondweed and Eurasian milfoil
   - A. Treat 30 acres with Aquathol K (Silver and North Little Lakes) $ 9,700
   - B. North Little Lake Eurasian Watermilfoil
     Treat 10 acres with 2, 4-D $ 3,750
2. Conduct a late season Tier II survey to monitor both invasive and native plant populations.
   - A. Spring Vegetation Survey and Plan Update $ 4,000

Acknowledgements

Aquatic vegetation surveys and herbicide treatments conducted on Silver Lake were made possible by funding from the Silver Lake Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for Tier II aquatic vegetation surveys. IDNR District 4 Fisheries Biologist Ed Braun provided consultation in the development of this management strategy. Gwen White and Angela Sturdevant, aquatic biologists for the IDNR Division of Fish and Wildlife provided valuable consultation regarding the requirements and objectives of this lake management plan. Aquatic Weed Control would also like to thank the members of the Silver Lake Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on June 9, 2007.

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1.0 Introduction

Silver Lake has been involved in the Lake and River Enhancement Program (LARE) since 2004, when the first LARE funded aquatic vegetation survey took place on July 12, 2004. Based on the results of this survey, curly leaf pondweed was very prevalent in Silver Lake, and the areas of infestation were targeted for early season Aquathol K herbicide treatments. Early season curly leaf pondweed treatments have been conducted on Silver Lake for 3 consecutive years, while they have been conducted on North Little Lake for 2 consecutive years. North Little Lake was treated for the control of EWM for the first time in 2007. The following chart summarizes all LARE funded activities on Silver Lake. The time frame for the original management plan was 2004 through 2008.

Table 1: Silver Lake LARE History

Year	Action	Date	Funding Source
2004	Late Season Aquatic Vegetation Survey. Aquatic Vegetation Management Plan Development	Late Season Survey August 25, 2004	Lake and River Enhancement Silver Lake Association
2005	Spring and Late Season Aquatic Vegetation Surveys as well Aquathol K application and Aquatic Vegetation Management Plan Development	Spring Survey April 14, 2005 Aquathol K Application ~30 acres –Silver Lake- April 15, 2005 July Survey July 15, 2005	Lake and River Enhancement Silver Lake Association
2006	Spring and Late Season Aquatic Vegetation Surveys as well Aquathol K application and Aquatic Vegetation Management Plan Development	Spring Survey April 20, 2006 Aquathol K Application ~30 acres- April 26, 2006 Late Season Survey July 26, 2006	Lake and River Enhancement Silver Lake Association
2007	Spring and Fall Tier II Vegetation surveys as well as Aquathol K and 2, 4-D applications for CLP and EWM Aquatic Vegetation Management Plan Development	Spring Survey April 27, 2007 Aquathol K Application ~30 acres- April 27, 2006 2, 4-D Application for EWM June 19, 2007 Late Season Survey July 25, 2007	Lake and River Enhancement Silver Lake Association

The following list was compiled by the IDNR and gives both common and scientific names of many plants mentioned in this report. It also gives species codes which may be referenced on some data sheets.

Table 2: Common and Scientific Names of Plants

Species Code	Scientific Name	Common Name	Vegetation Type
ALGA	Any species of filamentous alga (incl. *Spyrogyra, Cladophora, Hydrodictyon*)	algae	N
AZO001	*Azolla* sp.	A mosquito fern species	N
AZOCAR	*Azolla caroliniana*	Carolina mosquito fern	N
AZOMEX	*Azolla mexicana*	Mexican mosquito fern	N
CERDEM	*Ceratophyllum demersum*	coontail	S
CHARA	*Chara* sp.	A chara species	S
EGEDEN	*EGERIA DENSA*	BRAZILIAN ELODEA	S
ELOCAN	*Elodea Canadensis*	Canada waterweed	S
ELONUT	*Elodea nuttallii*	western waterweed	S
HYIVER	*HYDRILLA VERTICILLATA*	HYDRILLA	S
LEM001	*Lemna* sp.	duckweeds (species within Lemnaceae)	N
LEMMIO	*Lemna minor*	small or common duckweed	N
LEMTRI	*Lemna trisulca*	star duckweed	N
LUDDEC	*Ludwigia decurrens*	primrose-willow	F
MYRSIB	*Myriophyllum sibiricum*	northern watermilfoil	S
MYRSPI	*MYRIOPHYLLUM SPICATUM*	EURASIAN WATERMILFOIL	S
MYR001	*Myriophyllum* sp.	a watermilfoil species	S
NAJFLE	*Najas flexilis*	slender naiad	S
NAJGRA	*Najas gracillima*	Northern naiad	S
NAJGUA	*Najas guadalupensis*	Southern naiad	S
NAJMIN	*NAJAS MINOR*	BRITTLE WATERNYMPH	S
NELLUT	*Nelumbo lutea*	American lotus	F
NITELL	*Nitella* sp.	a nitella species	S
NOAQVG		no aquatic vegetation at site	N
NUPADV	*Nuphar advena*	spatterdock	F
NUPVAR	*Nuphar variegata* (formerly *N. luteum*)	bullhead lily (yellow pond lily)	F
NYMODT	*Nymphaea oderata subsp. tuberosa*	white water lily (fragrant water lily)	F

POTCRI	*POTAMOGETON CRISPUS*	CURLY-LEAF PONDWEED	S
POTEPI	*Potamogeton epihydrus*	ribbon-leaf pondweed	S
POTFOF	*Potamogeton foliosus*	leafy pondweed	S
POTGRA	*Potamogeton gramineus*	variable pondweed	S
POTILL	*Potamogeton illinoensis*	Illinois pondweed	S
POTNLV	*Potamogeton foliosus*, *P. pusillus*, or other unidentified narrow-leaved pondweeds	narrow-leaved pondweeds	S
POTNOD	*Potamogeton nodosus* (formerly *P. americanus*)	American pondweed	S
POTPRA	*Potamogeton praelongus*	white-stemmed pondweed	S
POTPUP	*Potamogeton pusillus*	small pondweed	S
POTRIC	*Potamogeton richardsonii*	Richardson's pondweed	S
POTZOS	*Potamogeton zosteriformis*	flat-stemmed pondweed	S
RANFLA	*Ranunculus flabellaris*	yellow water crowfoot (yellow water buttercup)	S
RANLON	*Ranunculus longirostris* (incl. *R. trichophyllus*)	white water crowfoot (rigid white water crowfoot)	S
RICCIA	*Riccia* sp., *Ricciocarpus* sp.	A liverwort species	N
SPIPOL	*Spirodela polyrhiza*	greater duckweed	N
STUPEC	*Stuckenia pectinata*	sago pondweed	S
UNKN01		Unknown specimen No. 1	
UNKN02		Unknown specimen No. 2	
UTRMAC	*Utricularia macrorhiza* (also known as *U. vulgaris*)	common bladderwort	S
VALAME	*Vallisneria americana*	wild celery or eel grass	S
WOA001	*Wolffia* sp.	A watermeal species	N
WOACOL	*Wolffia columbiana*	watermeal	N
ZANPAL	*Zannichellia palustris*	horned pondweed	S
ZOSDUB	*Zosterella dubia* (also known as *Heteranthera dubia*)	water stargrass	S

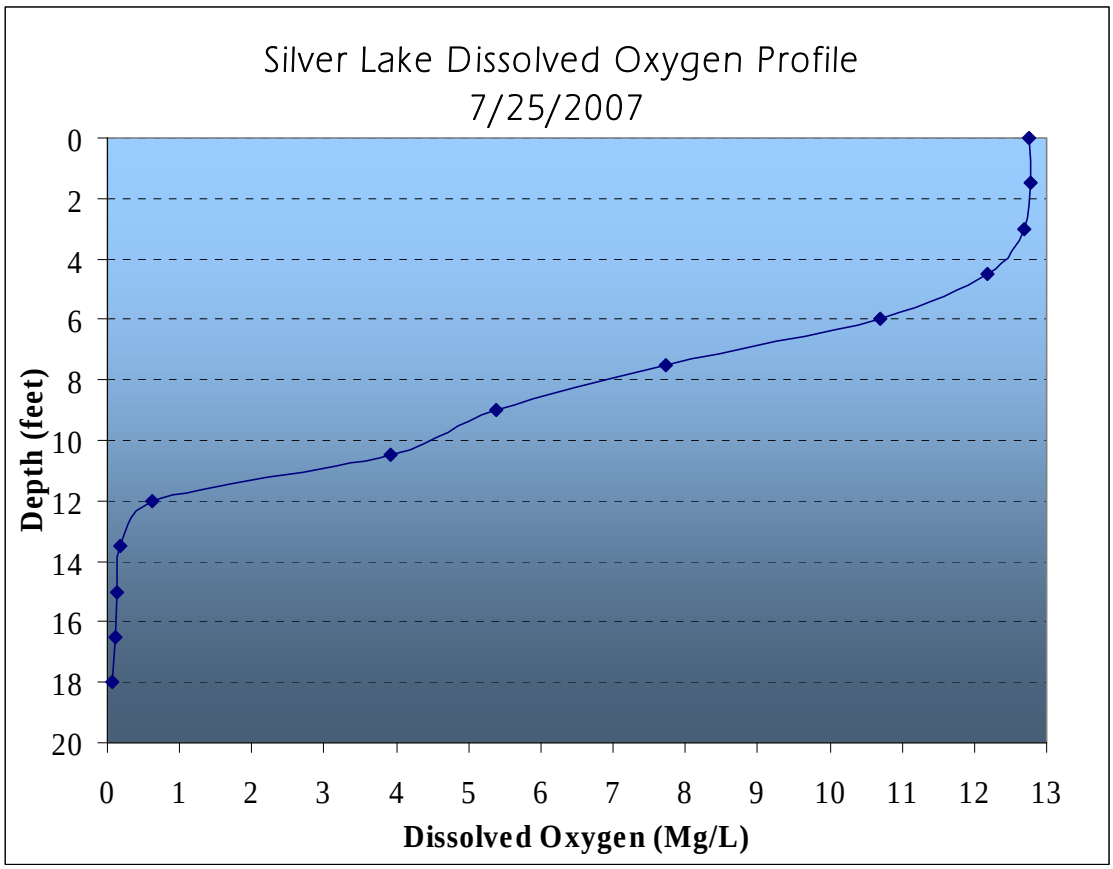
Note: The scientific and common names of EXOTIC species are shown in ALL CAPITAL LETTERS.

Key to Vegetation Types:
F = floating-leaved, rooted vegetation
N = non-rooted floating vegetation
S = submersed vegetation

2.0 Watershed and Lake Characteristics Update

Secchi depth in Silver Lake was measured at 4.0 feet on April 27, 2007 and at 3.5 feet on July 25, 2007 by Aquatic Weed Control. On July 25, 2007 Aquatic Weed Control measured dissolved oxygen and temperature throughout the water column in Silver Lake. This data was used to construct dissolved oxygen and temperature profiles for Silver Lake. Figure 1 shows oxygen levels in Silver Lake.

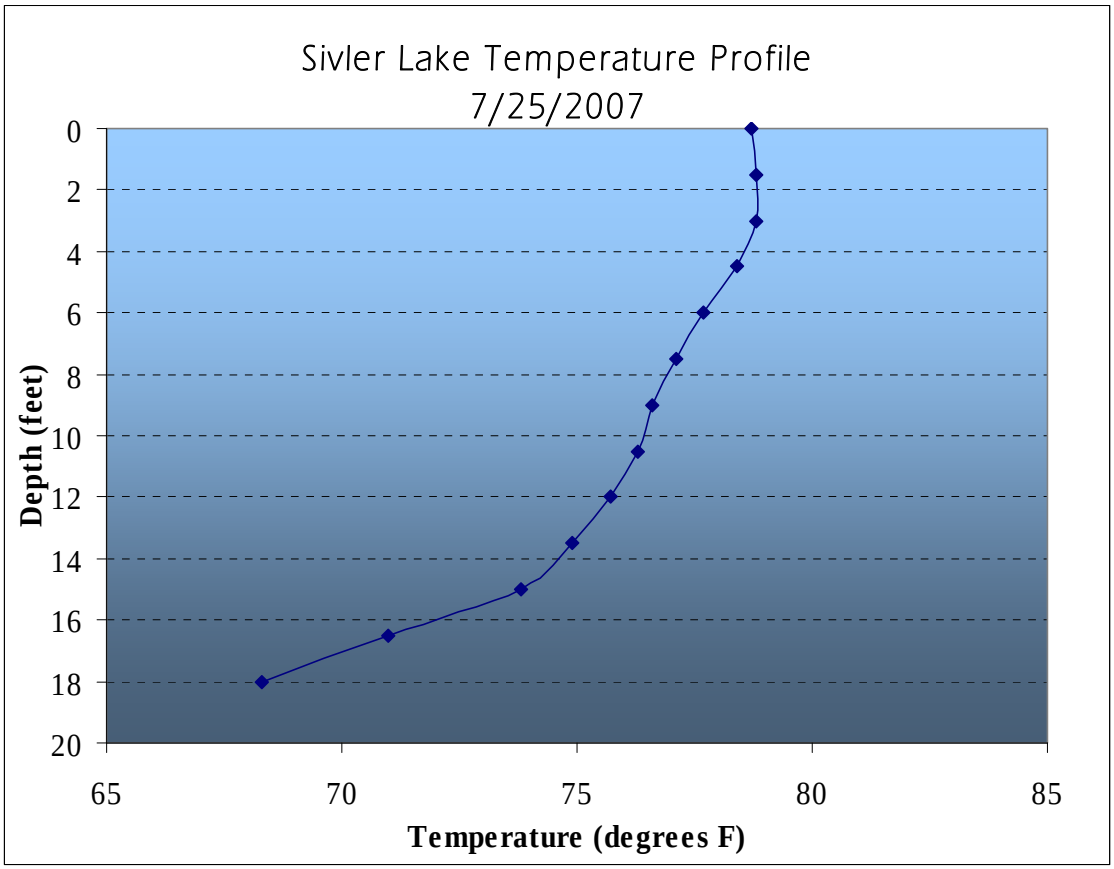
Figure 1: Silver Lake Dissolved Oxygen Profile



Dissolved oxygen requirements to maintain healthy fish populations of warm-water species are at least 2-5 mg of oxygen per liter of water, while cold-water fish species require 5-9 mg of oxygen per liter of water (Kalff, 2002, p237).

The metalimnion is the transition zone between the surface water and the deep water. It is usually accompanied by rapid changes in dissolved oxygen and temperature. The metalimnion in Silver Lake is between 4 and 12 feet, characterized by a rapid loss of dissolved oxygen. On July 25, 2007, Silver Lake had adequate oxygen to support fish life down to roughly 10 feet. Figure 2 shows temperature data from Silver Lake.

Figure 2: Silver Lake Temperature Profile



The thermocline is a rapid temperature change associated with the transition from surface water to deep water. In Silver Lake water temperature remains stable from the surface down to only 4 feet. Temperature then drops with depth. This indicates the beginning of a thermocline at around 4 feet. Temperature drops even more rapidly between 12 and 18 feet.

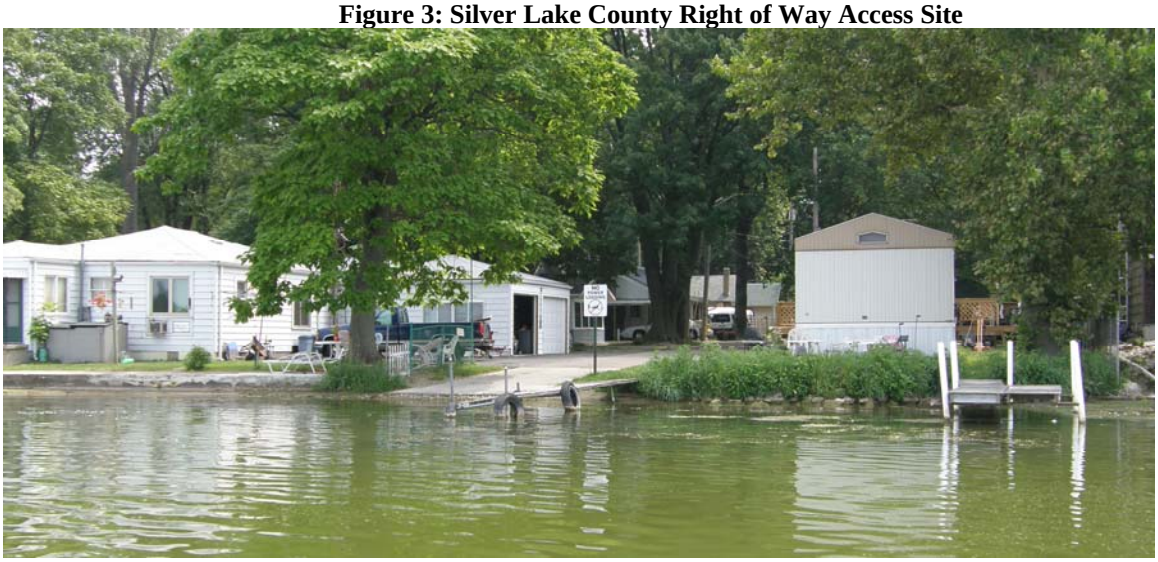
Nutrient and Sediment Removal

Silver lake has needs for both sediment removal and dam improvements to deal with recent flooding issues. Street drainage form the town of Silver Lake may add to nutrient and sediment problems. Sediment removal is greatly needed in the area around the main inlet. The Silver lake watershed did recently receive a grant through the soil and water conservation district. No recent water quality monitoring has taken place and no other recent studies have been conducted on the Silver Lake watershed (Walker, 2008).

3.0 Lake Uses Update

Silver Lake continues to receive very high levels of public use during the summer months. No IDNR public access site is available, but boaters and fishermen enter the lake from the county right of way access and a private access point on Silver Lake. Figure 3 shows the County road right of way access ramp on the east shore of Silver Lake.

Figure 3: Silver Lake County Right of Way Access Site



The lake is popular with many fishermen, as the major sport species are panfish and largemouth bass. Coontail still impedes use of the lake in many areas. It grows to nuisance levels and causes limitations on boat travel. Figure 4 shows one area of matted coontail and filamentous algae on Silver Lake.

Figure 4: Silver Lake Coontail Bed

4.0 Fisheries Update

Ed Braun, District 4 Fisheries Biologist was contacted, and the most recent fisheries survey on Silver Lake took place in 2006 (Benson, 2006). It was included in the 2006 Aquatic Vegetation Management Plan Update.

5.0 Problem Statement

Curly leaf pondweed will continue to be the major challenge in Silver Lake, while Eurasian watermilfoil and curly leaf pondweed are both challenges in maintaining a healthy plant community in North Little Lake. Early season Aquathol treatments provide effective control for curly leaf pondweed and overall infestation should decrease as a result of the treatment program. In North Little Lake 2, 4-D treatments provide maintenance for Eurasian watermilfoil. These treatments should help native species compete with these invasive plants. Coontail, a native species in Silver Lake is also present at nuisance levels in many areas. Coontail treatments are not eligible for LARE funding.

6.0 Management Goals and Objectives

The management goals outlined by the IDNR Division of Fish and Wildlife have not changed. They are restated below:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

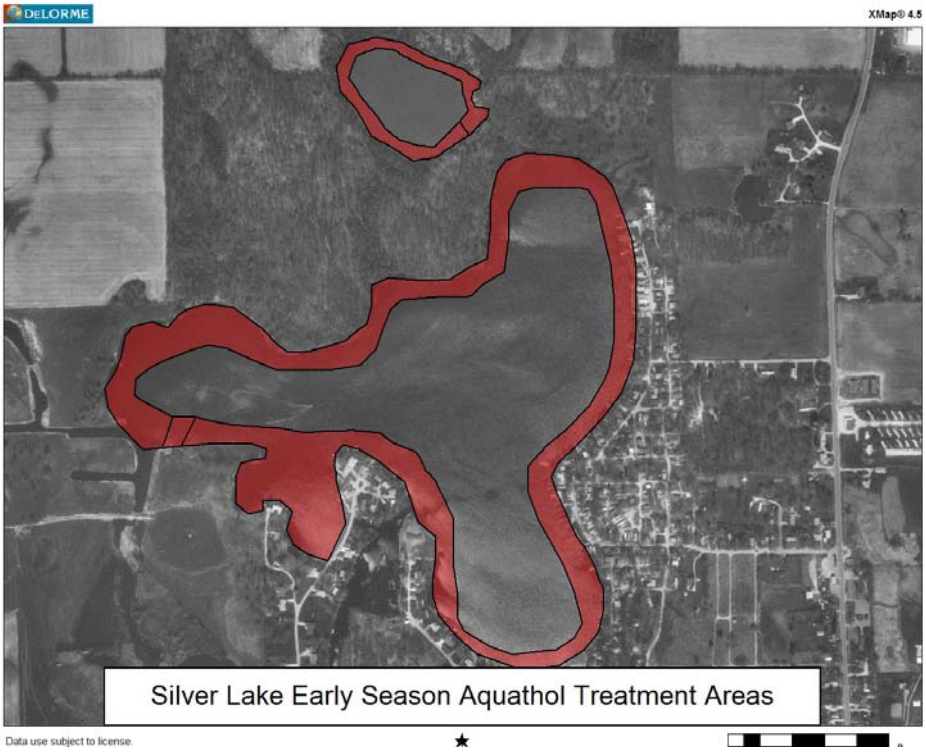
7.0 Plant Management History Update

Ed Braun, District 4 Fisheries Biologist was contacted to determine any significant changes in vegetation control permits. Acreages for the treatment of private lots have not changed significantly. One small area was treated for coontail with private funding in summer of 2007. The area was approximately 2.5 acres and is located on the west end of Silver Lake. Figure 5 shows this treatment area.

Figure 5: Silver Lake Private Treatment Area

Aquathol treatments for curly leaf pondweed in both Silver and North Little Lakes continued in 2007. Approximately 30 acres were treated with Aquathol on April 27, 2007. Treatment areas did not change from 2006. Curly leaf pondweed treatment areas are shown in Figure 6. North Little Lake was treated for Eurasian watermilfoil with 2, 4-D on June 19, 2007.

Figure 6: Silver Lake LARE Treatment Areas



8.0 Aquatic Plant Community Characterization Update

One major change in protocol for 2007 is the absence of the Tier I reconnaissance survey. Survey intensity is now being tailored to individual lakes, depending on their own unique set of circumstances and management activities. Some lakes which may have been surveyed twice annually in the past may only be surveyed once each season. Surveys on some lakes that have been intensely surveyed in recent years may change to visual surveys as opposed to more time consuming quantitative vegetation surveys. These changes provide better quality of service and more efficient use of funding on Indiana lakes.

An updated Tier II survey protocol has been established by the IDNR. These changes are outlined in the methods section (8.1). Figure 7 shows curly leaf pondweed distribution in Silver and North Little Lakes prior to treatment in 2007.

Figure 7: Pre-Treatment Curly Leaf Pondweed Distribution

8.1 Methods Update

The Tier II survey protocol was updated by the IDNR in 2006 and 2007. The 2006 Tier II protocol requires that sample sites be stratified by depth contour and that data analysis be provided for each depth contour. Rake scores for plant species are recorded as 1, 3, or 5, as opposed to the original scoring system of 1, 2, 3, 4, or 5.

The number of sample sites needed for a Tier II survey is still based on lake size as it was in 2006. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi depth, and nutrient availability. There are 4 different trophic states listed by the IDNR: oligotrophic, mesotrophic, eutrophic, and hypereutrophic. Oligotrophic lakes usually have clear water and few nutrients, while hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 3 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 3: Sample Depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 4 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 4: Sample Sites by Lake Size and Trophic State

Tier II Sampling 3

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

		Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
Lake Acres	Total # of Sites	0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

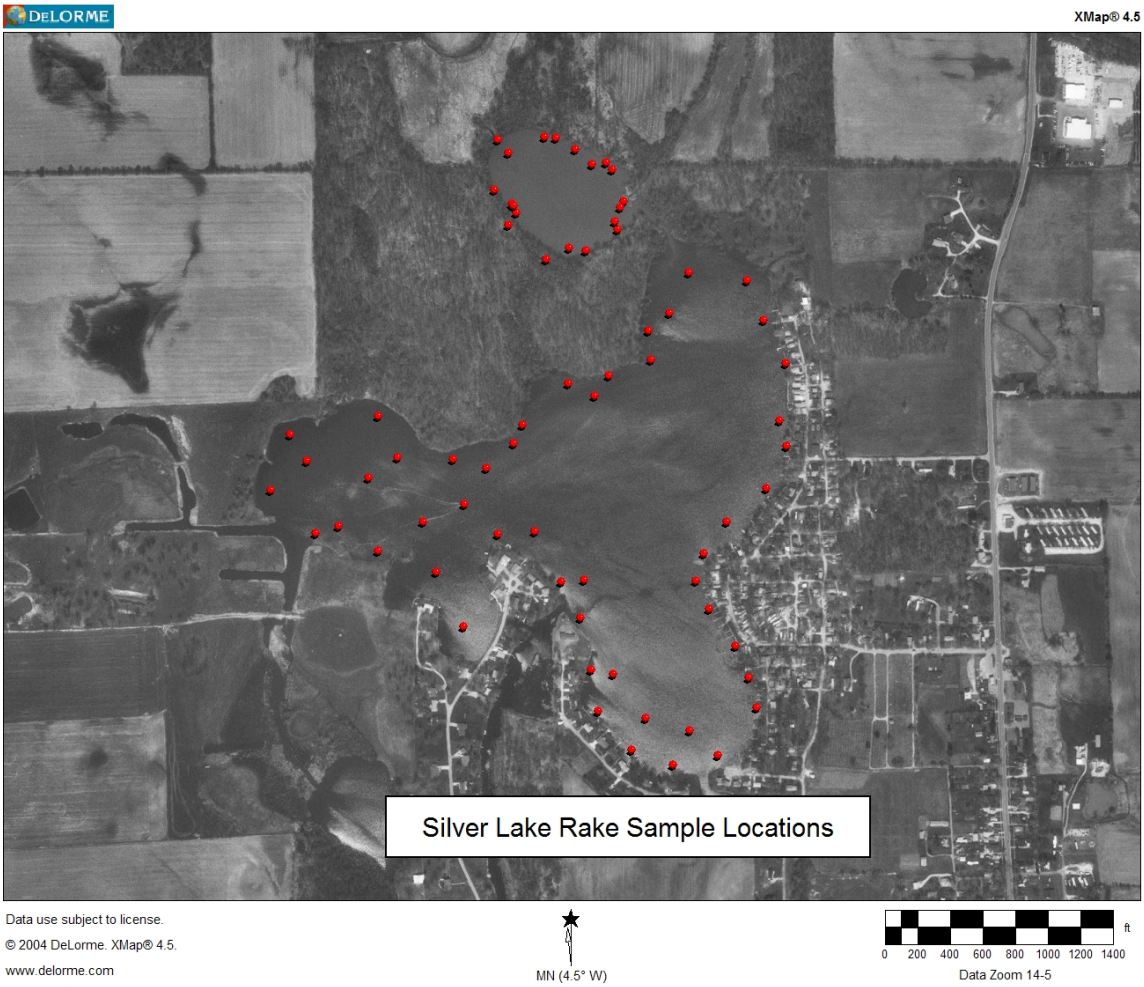
Silver Lake is characterized by the IDNR as eutrophic with 102 surface acres. Maximum sampling depth was 15 feet in Silver and North Little Lakes. In accordance with the protocol 50 total sample

sites are collected in Silver Lake with 23 sites in 0 – 5 feet of water, 17 sites in 5 – 10 feet of water and 10 sites in 10 – 15 feet of water. North Little Lake is not included in the IDNR lakes classification chart but is roughly 10 acres. Twenty sample sites are collected in North Little Lake with 10 sites in 0 – 5 feet of water, 8 sites in 5 – 10 feet of water and 2 sites in 10 -15 feet of water. At this time no changes in sampling distribution are recommended for Silver and North Little Lakes.

8.2.2 Tier II Results

Two Tier II vegetation surveys were conducted in 2007. The first was on April 27, 2007 and the second was on July 25, 2007. Secchi depth was measured at 4.0 feet on April 27, and 3.5 feet on July 25. Fifty rake samples were divided between each 5 foot depth contour of Silver Lake's littoral zone in each survey. Twenty sample sites were distributed throughout the littoral zone of North Little Lake. The following map shows the locations of all sample sites during the 2007 Tier II surveys. Sample sites are identical to 2006 sample sites.

Figure 8: Silver Lake Rake Sample Locations



Tier II Data Analysis

The following tables are data summaries for the 2007 aquatic vegetation surveys. These tables help to describe the plant community and will help identify any changes that take place in the years to

come. Tables labeled as "Overall" analyze each sample site in Silver and North Little Lakes. The other tables describe plants found in each depth contour of the littoral zones (0-5 feet, 5-10 feet, etc).

In the data analysis tables, "littoral sites" indicates the number of sample sites which had a depth that was less than the maximum depth at which plants were found. The littoral depth indicates the maximum depth at which plants were found.

Silver Lake April 2007 Data Analysis

Table 5: Silver Lake April Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Silver Lake	Secchi:	4.0	SE Mean Species/site:	0.11
Date:	4/27/07	Littoral sites with plants:	29	Mean natives/site:	0.66
Littoral depth (ft):	9.0	Number of species:	6	SE Mean natives/site:	0.09
Littoral sites:	38	Maximum species/site:	2	Species diversity:	0.40
Total sites:	50	Mean number species/site:	0.76	Native diversity:	0.22

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	58.0	14.0	20.0	24.0	38.8
Curly-leaf Pondweed	8.0	8.0	0.0	0.0	1.6
Leafy Pondweed	4.0	4.0	0.0	0.0	0.8
Elodea	2.0	2.0	0.0	0.0	0.4
Eurasian Watermilfoil	2.0	2.0	0.0	0.0	0.4
Slender Naiad	2.0	2.0	0.0	0.0	0.4
Filamentous Algae	70.0				

Table 6: Silver Lake April Data Analysis - 0-5 feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet

Lake:	Silver Lake	Secchi:	4.0	SE Mean Species/site:	0.12
Date:	4/27/07	Littoral sites with plants:	22	Mean natives/site:	1.13
Littoral depth (ft):	9.0	Number of species:	6	SE Mean natives/site:	0.10
Littoral sites:	23	Maximum species/site:	2	Species diversity:	0.47
Total sites:	23	Mean number species/site:	1.35	Native diversity:	0.28

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	95.7	8.7	34.8	52.2	74.8
Curly-Leaf Pondweed	17.4	17.4	0.0	0.0	3.5
Leafy Pondweed	8.7	8.7	0.0	0.0	1.7
Elodea	4.3	4.3	0.0	0.0	0.9
Eurasian Watermilfoil	4.3	4.3	0.0	0.0	0.9
Slender Naiad	4.3	4.3	0.0	0.0	0.9
Filamentous Algae	100.0				

Table 7: Silver Lake April Data Analysis - 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	Silver Lake	Secchi:	4.0	SE Mean Species/site:	0.12
Date:	4/27/07	Littoral sites with plants:	7	Mean natives/site:	0.41
Littoral depth (ft):	9.0	Number of species:	1	SE Mean natives/site:	0.12
Littoral sites:	15	Maximum species/site:	1	Species diversity:	0.00
Total sites:	17	Mean number species/site:	0.41	Native diversity:	0.00

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	41.2	29.4	11.8	0.0	12.9
Filamentous Algae	58.8				

No plants were found deeper than 9 feet in Silver Lake in spring of 2007.

North Little Lake Spring 2007 Data

Table 8: North Little Lake April Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	North Little	Secchi:	4.0	SE Mean Species/site:	0.16
Date:	4/27/07	Littoral sites with plants:	13	Mean natives/site:	0.57
Littoral depth (ft):	10.0	Number of species:	4	SE Mean natives/site:	0.11
Littoral sites:	17	Maximum species/site:	2	Species diversity:	0.52
Total sites:	20	Mean number species/site:	0.81	Native diversity:	0.15

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	55.0	40.0	10.0	5.0	19.0
Curly-leaf Pondweed	20.0	20.0	0.0	0.0	4.0
Elodea	5.0	5.0	0.0	0.0	1.0
Eurasian Watermilfoil	5.0	5.0	0.0	0.0	1.0
Filamentous Algae	15.0				

Table 9: North Little Lake April Data Analysis - 0 -5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet					
Lake:	North Little	Secchi:	4.0	SE Mean Species/site:	0.16
Date:	4/27/07	Littoral sites with plants:	10	Mean natives/site:	1.00
Littoral depth (ft):	10.0	Number of species:	3	SE Mean natives/site:	0.00
Littoral sites:	10	Maximum species/site:	2	Species diversity:	0.50
Total sites:	10	Mean number species/site:	1.40	Native diversity:	0.18

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	90.0	60.0	20.0	10.0	34.0
Curly-leaf Pondweed	40.0	40.0	0.0	0.0	8.0
Elodea	10.0	10.0	0.0	0.0	2.0
Filamentous Algae	10.0				

Table 10: North Little Lake April Data Analysis - 5-10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	North Little	Secchi:	4.0	SE Mean Species/site:	0.18
Date:	4/27/07	Littoral sites with plants:	3	Mean natives/site:	0.25
Littoral depth (ft):	10.0	Number of species:	2	SE Mean natives/site:	0.16
Littoral sites:	8	Maximum species/site:	1	Species diversity:	0.44
Total sites:	8	Mean number species/site:	0.38	Native diversity:	0.00

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	25.0	25.0	0.0	0.0	5.0
Eurasian Watermilfoil	12.5	12.5	0.0	0.0	2.5
Filamentous Algae	25.0				

No plants were found deeper than 10 feet in North Little Lake in Spring of 2007.

Silver Lake Fall 2007 Data

Table 11:Silver Lake July Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	Silver lake	Secchi:	3.5	SE Mean Species/site:	0.11
Date:	7/25/07	Littoral sites with plants:	32	Mean natives/site:	0.78
Littoral depth (ft):	10.0	Number of species:	6	SE Mean natives/site:	0.10
Littoral sites:	40	Maximum species/site:	3	Species diversity:	0.46
Total sites:	50	Mean number species/site:	0.86	Native diversity:	0.36

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	62.0	18.0	20.0	24.0	39.6
Curly-leaf Pondweed	8.0	8.0	0.0	0.0	1.6
Slender Naiad	6.0	2.0	4.0	0.0	2.8
Chara	4.0	4.0	0.0	0.0	0.8
Duckweed	4.0	4.0	0.0	0.0	0.8
Elodea	2.0	2.0	0.0	0.0	0.4
Filamentous Algae	38.0				

Table 12: Silver Lake July Data Analysis - 0-5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet					
Lake:	Silver lake	Secchi:	3.5	SE Mean Species/site:	0.15
Date:	7/25/07	Littoral sites with plants:	20	Mean natives/site:	1.04
Littoral depth (ft):	10.0	Number of species:	5	SE Mean natives/site:	0.12
Littoral sites:	23	Maximum species/site:	3	Species diversity:	0.51
Total sites:	23	Mean number species/site:	1.22	Native diversity:	0.36

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	82.9	4.3	30.4	47.8	67.0
Curly-leaf Pondweed	17.4	17.4	0.0	0.0	3.5
Slender Naiad	8.7	4.3	4.3	0.0	3.5
Chara	8.7	8.7	0.0	0.0	1.7
Duckweed	4.3	4.3	0.0	0.0	0.9
Filamentous Algae	69.6				

Table 13: Silver Lake July Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	Silver lake	Secchi:	3.5	SE Mean Species/site:	0.17
Date:	7/25/07	Littoral sites with plants:	12	Mean natives/site:	0.88
Littoral depth (ft):	10.0	Number of species:	4	SE Mean natives/site:	0.17
Littoral sites:	17	Maximum species/site:	2	Species diversity:	0.35
Total sites:	17	Mean number species/site:	0.88	Native diversity:	0.35

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	70.6	47.1	17.6	5.9	25.9
Slender Naiad	5.9	0.0	5.9	0.0	3.5
Duckweed	5.9	5.9	0.0	0.0	1.2
Elodea	5.9	5.9	0.0	0.0	1.2
Filamentous Algae	17.6				

No plants were found deeper than 10 feet in Silver Lake in fall of 2007.

North Little Lake Fall 2007 Data

Table 14: North Little Lake July Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	North Little	Secchi:	3.5	SE Mean Species/site:	0.2
Date:	7/25/07	Littoral sites with plants:	16	Mean natives/site:	0.80
Littoral depth (ft):	13.0	Number of species:	4	SE Mean natives/site:	0.09
Littoral sites:	18	Maximum species/site:	3	Species diversity:	0.54
Total sites:	20	Mean number species/site:	1.20	Native diversity:	0.12

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	75.0	25.0	35.0	15.0	41.0
Curly-leaf Pondweed	30.0	25.0	5.0	0.0	8.0
Eurasian Watermilfoil	10.0	10.0	0.0	0.0	2.0
Small Pondweed	5.0	0.0	5.0	0.0	3.0
Filamentous Algae	20.0				

Table 15: North Little Lake July Data Analysis 0-5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet					
Lake:	North Little	Secchi:	3.5	SE Mean Species/site:	0.27
Date:	7/25/07	Littoral sites with plants:	10	Mean natives/site:	1.00
Littoral depth (ft):	13.0	Number of species:	3	SE Mean natives/site:	0.00
Littoral sites:	10	Maximum species/site:	3	Species diversity:	0.53
Total sites:	10	Mean number species/site:	1.60	Native diversity:	0.00

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	100.0	20.0	60.0	20.0	60.0
Curly-leaf Pondweed	40.0	30.0	10.0	0.0	12.0
Eurasian Watermilfoil	20.0	20.0	0.0	0.0	4.0
Filamentous Algae	40.0				

Table 16: North Little Lake July Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	North Little	Secchi:	3.5	SE Mean Species/site:	0.31
Date:	7/25/07	Littoral sites with plants:	5	Mean natives/site:	0.71
Littoral depth (ft):	13.0	Number of species:	3	SE Mean natives/site:	0.18
Littoral sites:	7	Maximum species/site:	2	Species diversity:	0.57
Total sites:	7	Mean number species/site:	1.00	Native diversity:	0.32

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	57.1	28.6	14.3	14.3	28.6
Curly-leaf Pondweed	28.6	28.6	0.0	0.0	5.7
Small Pondweed	14.3	0.0	14.3	0.0	8.6
Filamentous Algae	0.0				

Table 17: North Little Lake July Data Analysis 10 - 15 Feet

Occurrence and Abundance of Submersed Aquatic Plants 10-15 Feet					
Lake:	North Little	Secchi:	3.5	SE Mean Species/site:	0.33
Date:	7/25/07	Littoral sites with plants:	1	Mean natives/site:	0.33
Littoral depth (ft):	13.0	Number of species:	1	SE Mean natives/site:	0.33
Littoral sites:	1	Maximum species/site:	1	Species diversity:	0.00
Total sites:	3	Mean number species/site:	0.33	Native diversity:	0.00

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	33.3	33.3	0.0	0.0	6.7

No plants were collected deeper than 13 feet in North Little Lake in fall of 2007.

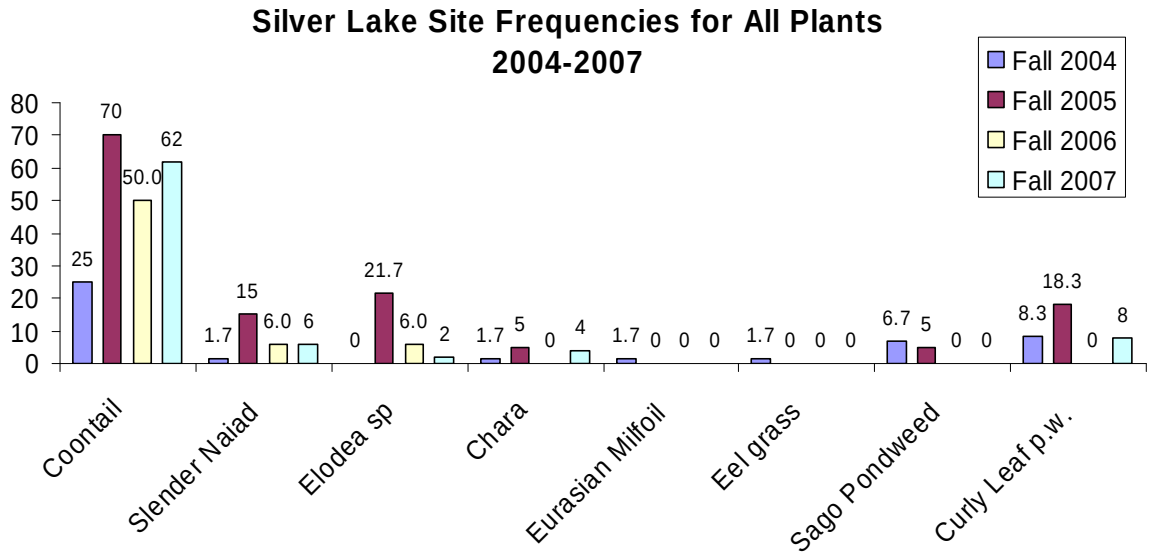
Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \frac{(\text{\# of sites where the species was collected})}{\text{Total \# of littoral sample sites}} \times 100$$

Table 18 shows site frequencies for every plant collected in any of the late season Tier II surveys since the lake was involved in the LARE program with the exception of duckweed. Natural die offs make it difficult to describe the curly leaf pondweed population in late summer. This year a Tier II survey was conducted in spring, and another will be conducted in spring of 2008. Coontail remains the most frequently collected plant in every survey. Slender naiad, chara, and curly leaf pondweed are the other most common plants in Silver Lake.

Table 18: Silver Lake Site Frequency History



Species Diversity

The species diversity indices listed in data analysis tables describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

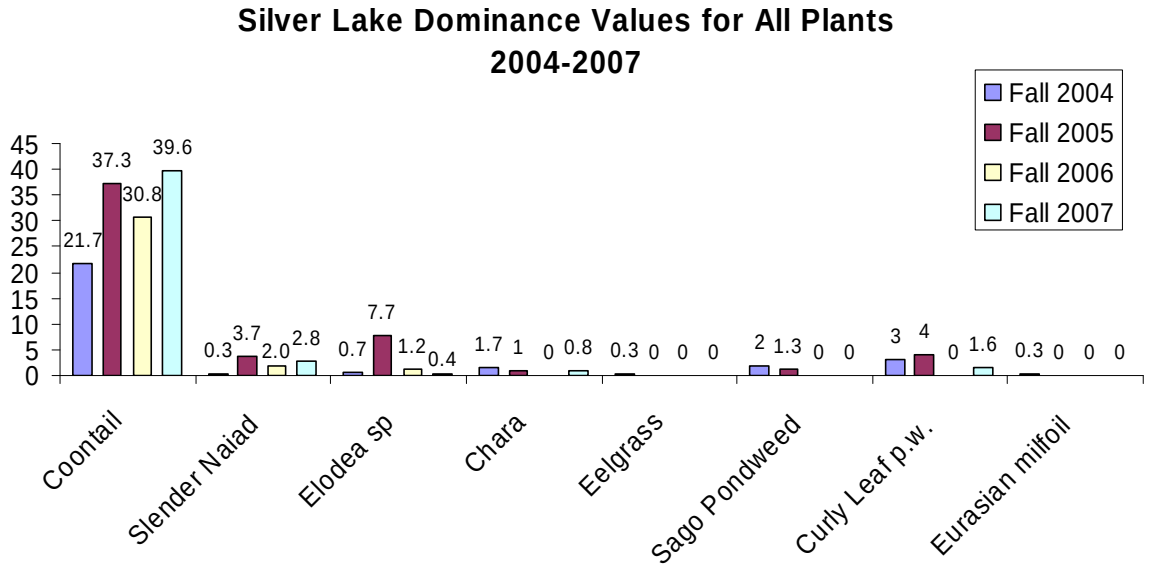
The species diversity index for Silver Lake in July of 2007 was 0.46, up from 0.33 in July of 2006. Native plant diversity in July of 2007 was 0.36, also up slightly from 0.33 in July of 2006. North Little Lake species diversity in July of 2007 was 0.54, which is down from 0.72 in July of 2006. Native diversity was 0.12, which was down from 0.57 in July of 2006.

Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 19 tracks dominance values for each plant collected at Silver Lake during its involvement in the LARE program with the exception of duckweed. Trends are similar to sight frequency, with coontail being by far the most dominant plant collected in each survey. Curly leaf pondweed may be under-represented in this graph as it usually dies off naturally during the summer.

Table 19: Silver Lake Plant Dominance History



8.3 Macrophyte Inventory Discussion

The submersed plant community of Silver Lake covers roughly 30 acres of Silver and North Little Lakes. Based upon 2007 survey data, curly leaf pondweed continues to occur in low abundances in Silver Lake and moderate abundance in North Little Lake. North Little Lake also has a moderate abundance of Eurasian watermilfoil that appears to be effectively controlled by 2, 4-D treatments.

Secchi disk readings are low, with readings of 4.0 and 3.5 feet recorded in 2007. A dissolved oxygen profile found adequate oxygen to support fish life down to roughly 10 feet.

Species diversity readings for Silver and North Little Lakes in fall of 2007 were 0.46 and 0.54 respectively.

Plants were found growing in slightly deeper water in North Little Lake, with coontail being collected in a depth of 13 feet. Four plants species were found in fall of 2007, although 2 of these species were invasive. North Little lake is a year behind Silver Lake in early season Aquathol treatments, and showed much higher site frequencies for curly leaf pondweed in 2007 (20 and 30 percent.

North Little Lake also has much more Eurasian watermilfoil than does Silver Lake. Site frequency of Eurasian watermilfoil in July of 2007 was at 10%. Eurasian watermilfoil should continue to be treated in North Little Lake to prevent its spread into Silver Lake.

Coontail is the most abundant plant throughout both lakes. Coontail frequencies in Silver Lake for spring and fall of 2007 were 58.0% and 62.0%. It grows to nuisance levels in many areas of the lake and impedes boat traffic.

In summary, Silver Lake is characterized by a submersed plant community with relatively low plant diversity, low water clarity (secchi depth 3.5 - 4 ft.), an abundant coontail population, as well as a low abundance of curly leaf pondweed. North Little Lake has a greater population of curly leaf pondweed, as well as moderate abundances of Eurasian watermilfoil.

Threatened and Endangered Species

The Indiana Natural Heritage Data Center is part of the Natural Heritage Network, a worldwide system of Heritage Programs. This program is designed to provide information about Indiana's diversity of natural ecosystems, species, landscape features, and outdoor amenities, and to assure adequate methods for evaluating this information and setting sound land protection priorities. The inventory is a continuous attempt to determine the state's most significant natural areas through an intensive statewide inventory.

The Indiana Natural Heritage Data Center has compiled a list of Indiana plant species that are federally or state listed as endangered, threatened or rare. The following is an excerpt taken directly from the Indiana Natural Heritage Database website. Link: Indiana Natural Heritage Data Center.

“The Indiana Natural Heritage Data Center, set up in 1978, represents a comprehensive process, becoming an increasingly valuable tool for decision makers and scientists as it progresses.”
No state or federally listed plant species were found in Silver Lake in 2007.

9.0 Aquatic Vegetation Management Alternatives

(See 2004 Lake Management Plan)
Major curly leaf pondweed control practices have not changed significantly from the 2004 alternatives.

10.0 Public Involvement

A LARE meeting was held on November 8, 2007 to discuss issues pertaining to Silver Lake. District 4 Fisheries Biologist, Ed Braun, Aquatic Weed Control, and LARE Aquatic biologists, Angela Sturdevant and Gwen White, were all present and discussed the plant community of Silver Lake.

A public lake meeting was held for Silver Lake on June 9, 2007. Monthly meetings are held starting in May and running through October. Next years meeting will likely be held in June as well. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined the treatment strategy to help contain both the curly leaf pondweed population and the Eurasian watermilfoil population in Silver and North Little Lakes. Residents were happy with curly leaf control and concerned about an overabundance of coontail

The Silver Lake Association is active, and lake association meetings help to keep the public informed about management practices on Silver Lake. Other avenues that may be used to inform the public would be periodic newsletters, an email list, an association website, or posting signs at public access sites.

Public questionnaires were not handed out at the public lake association meeting but will be handed out at next year's association meeting. Some citizens were concerned because of the amount of coontail in Silver Lake. Coontail is extremely abundant and causes major recreational interference in parts of Silver Lake. At this time, LARE will not fund any treatment for coontail, as it is a native plant. Any coontail treatments must be privately funded.

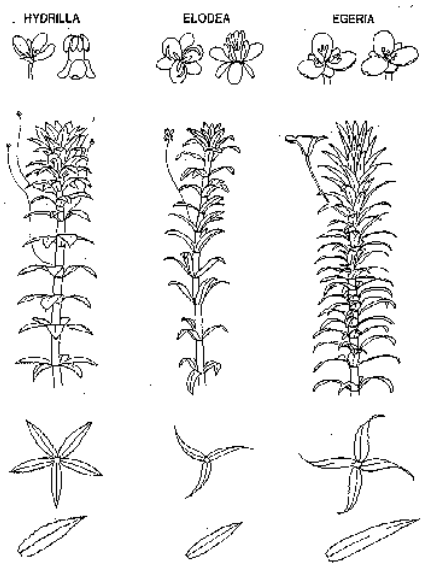
11.0 Public Education

The Silver Lake Association has been very aggressive in preventing the spread of invasive aquatic vegetation. They have submitted a proposal to the LARE program for additional herbicide treatment of curly leaf pondweed and Eurasian watermilfoil. This proposal resulted in the early season Aquathol and 2, 4-D treatments to control curly leaf pondweed and Eurasian watermilfoil.

More information on stopping the spread of invasive aquatic organisms can be found at http://www.protectyourwaters.net/. These items include thoroughly cleaning equipment after use in a lake and removing all water from bilges, livewells, etc.

11.1 Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is listed as a federally noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.



In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Management Action Strategy

The entire littoral zone of Silver and North Little Lakes (~30 acres) will be treated again in 2008 using Aquathol K to provide control of curly leaf pondweed. This will be the fourth consecutive early season Aquathol treatment for Silver Lake.

North Little Lake will be treated with Aquathol K for curly leaf pondweed as well. This will be the third consecutive early season Aquathol treatment for North Little Lake. Ideally, these treatments will take place in late April or early May when water temperatures are at or below 56 to 57 degrees Fahrenheit.

North Little Lake will be treated with 2, 4-D for the control of Eurasian watermilfoil. This treatment will take place later in summer, after the early season Aquathol treatment. These treatments are not expected to eradicate the two invasive species but should help native plants to compete with them. However, treating the curly leaf population early each year should reduce the amount of curly leaf turions left in the sediment, therefore further reducing the amount of curly leaf pondweed left in Silver and North Little Lakes. North Little Lake will likely be treated after 2008 since it is a year behind Silver Lake in early season Aquathol treatments. Silver Lake may not be treated after 2008.

A Tier II survey will be conducted on Silver and North Little Lakes in summer of 2007. This survey will determine the extent of curly leaf pondweed distribution and abundance.

The Lake and River Enhancement Program will likely not distribute funds for the control of native species, so additional treatments to control coontail will have to be privately funded.

Treatment Specifications

Aquathol K Treatments should be applied at a rate of 1 part per million to achieve adequate control of Curly Leaf Pondweed. Water temperature at the time of treatment should be at or below 56 to 57 degrees. 2, 4-D treatments should be applied at a rate of 1.76 parts per million to achieve adequate control of Eurasian watermilfoil.

13.0 Project Budget

2008 Cost Estimates:

*All cost figures are estimates only. All prices are subject to change pending 2008 chemical pricing.

1. Chemically treat areas infested by curly leaf pondweed and Eurasian milfoil
   - A. Treat the entire littoral zone with Aquathol K (Silver and North Little Lakes) $ 9,700
   - B. North Little Lake Eurasian Watermilfoil
     Treat 10 acres with 2, 4-D $ 3,750
2. Conduct a late season Tier II survey to monitor both invasive and native plant populations.
   - A. Spring Vegetation Survey and Plan Update $ 4,000

14.0 Monitoring and Plan Update Procedures

A Tier II quantitative survey should be conducted in summer of 2007 to evaluate the curly leaf pondweed population. This survey will take place after the early season Aquathol treatments. No spring survey will be necessary in 2008, as the lake has been extensively surveyed over the last three years.

Although no curly leaf pondweed turion survey will take place in 2008, a turion survey may be conducted in 2009 or 2010 following the early season Aquathol treatment program. This survey could give insight into the amount of turions present in the sediment of Silver and North Little Lakes.

15.0 References

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16.0 Appendices

16.1 Calculations

Fluridone Calculations:
The following paragraph is taken directly from the Sonar A.S. label. It outlines the specific procedures for calculating the amount of Fluridone needed to treat a body of water.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar A.S. to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:
Quarts of Sonar A.S. required per treated surface acre = Average water depth of treatment site (feet)
x Desired ppb concentration of active ingredient
x 0.0027
For example, the quarts per acre of Sonar A.S. required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:
5 **x** 25 **x** 0.0027 = 0.33 quarts per treated surface acre
When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured **x** 32. For example, 0.33 quarts **x** 32 = 10.5 fluid ounces.
Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

The following chart outlines rate calculations for DMA – 4 IVM Herbicide. It was taken directly from the DMA – 4 IVM specimen label on Dow AgroSciences website. http://www.dowagro.com/ivm/invasive/prod/dma.htm

Submerged Aquatic Weeds: Including Eurasian Water Milfoil *(Myriophyllum spicatum)*

Treatment Site	Maximum Application Rate †	Specific Use Directions
Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	**Application Timing:** For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas. **Subsurface Application:** Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift. **Surface Application:** Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre. **Aerial Application:** Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per surface acre. For Microfoil® drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre. Apply to attain a concentration of 2 to 4 ppm (see table below).

†DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Amount to Apply to Attain a Concentration of 2 to 4 ppm			
Surface Area	Average Depth (ft)	2,4-D Acid Equivalent to Apply (lb/acre)	Amount of DMA 4 IVM to Apply (gal/acre)
1 acre	1	5.4 to 10.8	1.42 to 2.84
	2	10.8 to 21.6	2.84 to 5.68
	3	16.2 to 32.4	4.26 to 8.53
	4	21.6 to 43.2	5.68 to 11.37
	5	27.0 to 54.0	7.10 to 14.21

The following table outlines rate calculations for Renovate 3 herbicide based on desired PPM and average depth of treatment area. It is taken directly from the Renovate 3 specimen label on SePRO Corporation's website: www.sepro.com

Concentration of Triclopyr Acid in Water (ppm ae)					
	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	3.3	3.6	4.6
3	2.1	2.9	4.1	5.4	6.8
4	2.7	3.6	5.4	7.2	9.1
5	3.4	4.5	6.8	9.0	11.3
6	4.1	5.4	8.1	10.9	13.6
7	4.8	6.3	9.5	12.7	15.8
8	5.5	7.2	10.9	14.5	18.1
9	6.1	8.1	12.2	16.3	20.4
10	6.8	9.0	13.6	18.1	22.6
15	10.2	13.6	20.4	27.2	33.9
20	13.6	18.1	27.2	36.2	45.3

16.2 Common Aquatic Plants of Indiana

(See 2004 Management Plan)

16.3 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 20: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	waiting period, in days						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

[d]May be used for sprinkling bent grass immediately.

[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.4 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.5 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:

(1) A privately owned lake, farm pond, or public or private drainage ditch.

(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:

(A) The area where vegetation is to be controlled does not exceed:

(i) twenty-five (25) feet along the legally established, average, or normal shoreline;

(ii) a water depth of six (6) feet; and

(iii) a total surface area of six hundred twenty-five (625) square feet.

(B) Control of vegetation does not occur in a public waterway of the state.

(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.

(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.

(d) This section does not do any of the following:

(1) Act as a bar to a suit or cause of action by a person or governmental agency.

(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.

(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).

As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits

Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.

(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:

(1) The common name of the plants to be controlled.

(2) The acreage to be treated.

(3) The maximum depth of the water where plants are to be treated.

(4) The name and amount of the chemical to be used.

(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.6 Species Distribution Maps

Figure 9: 2007 All Sample Locations

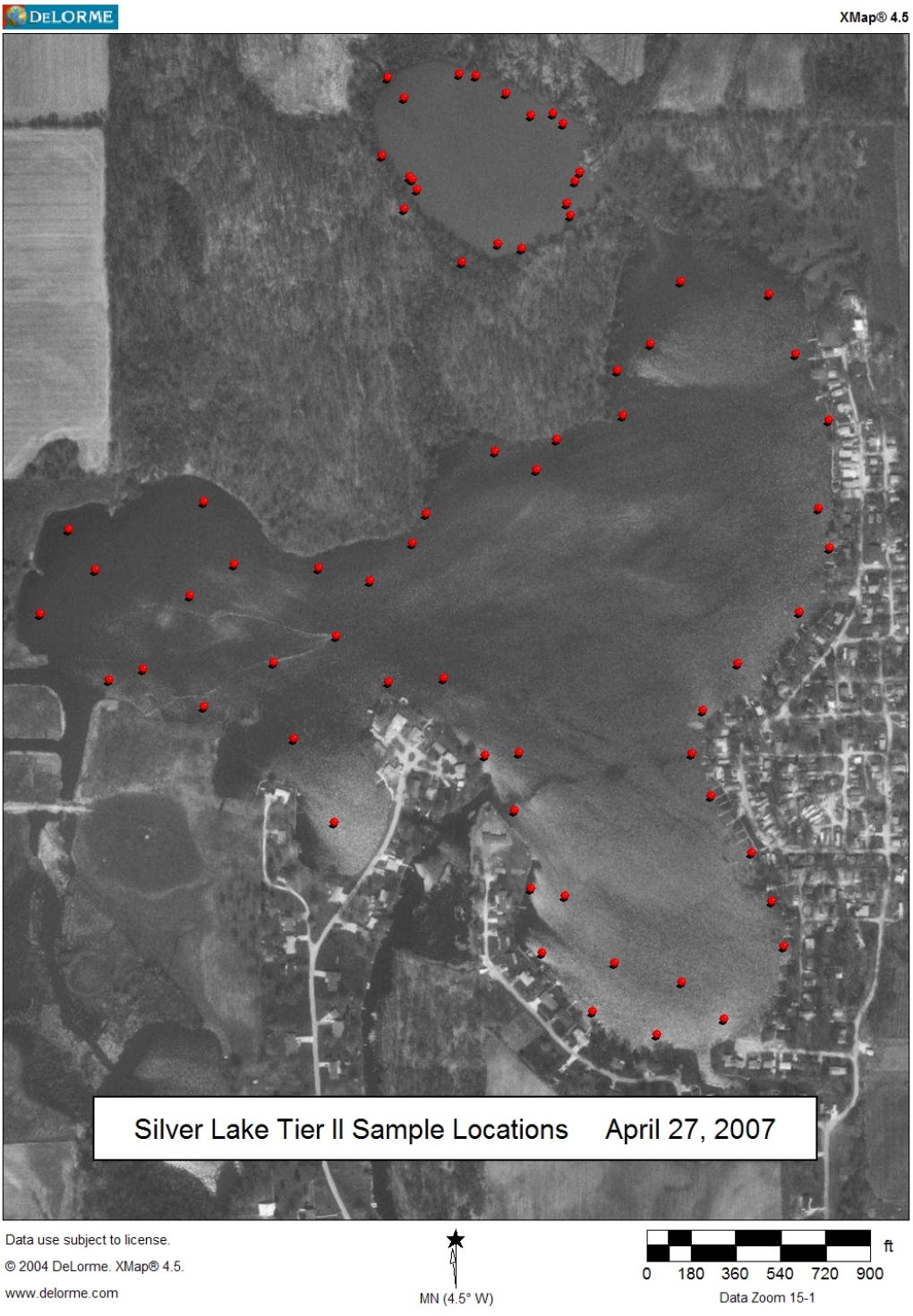


Figure 10: April 2007 Coontail Locations

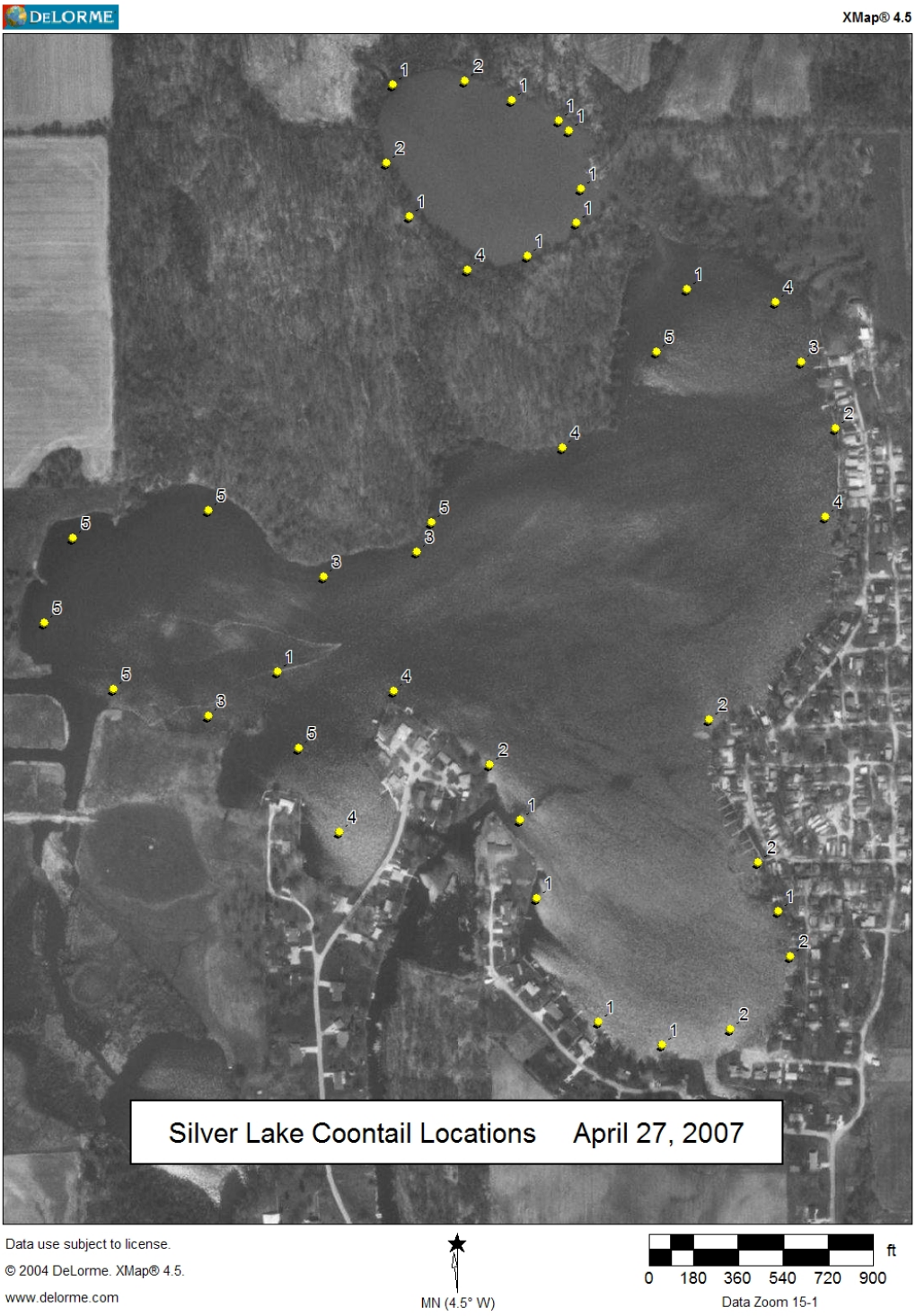


Figure 11: April 2007 Curly Leaf Pondweed Locations

Figure 12: April 2007 Eurasian Watermilfoil Locations

Figure 13: April 2007 Elodea Locations

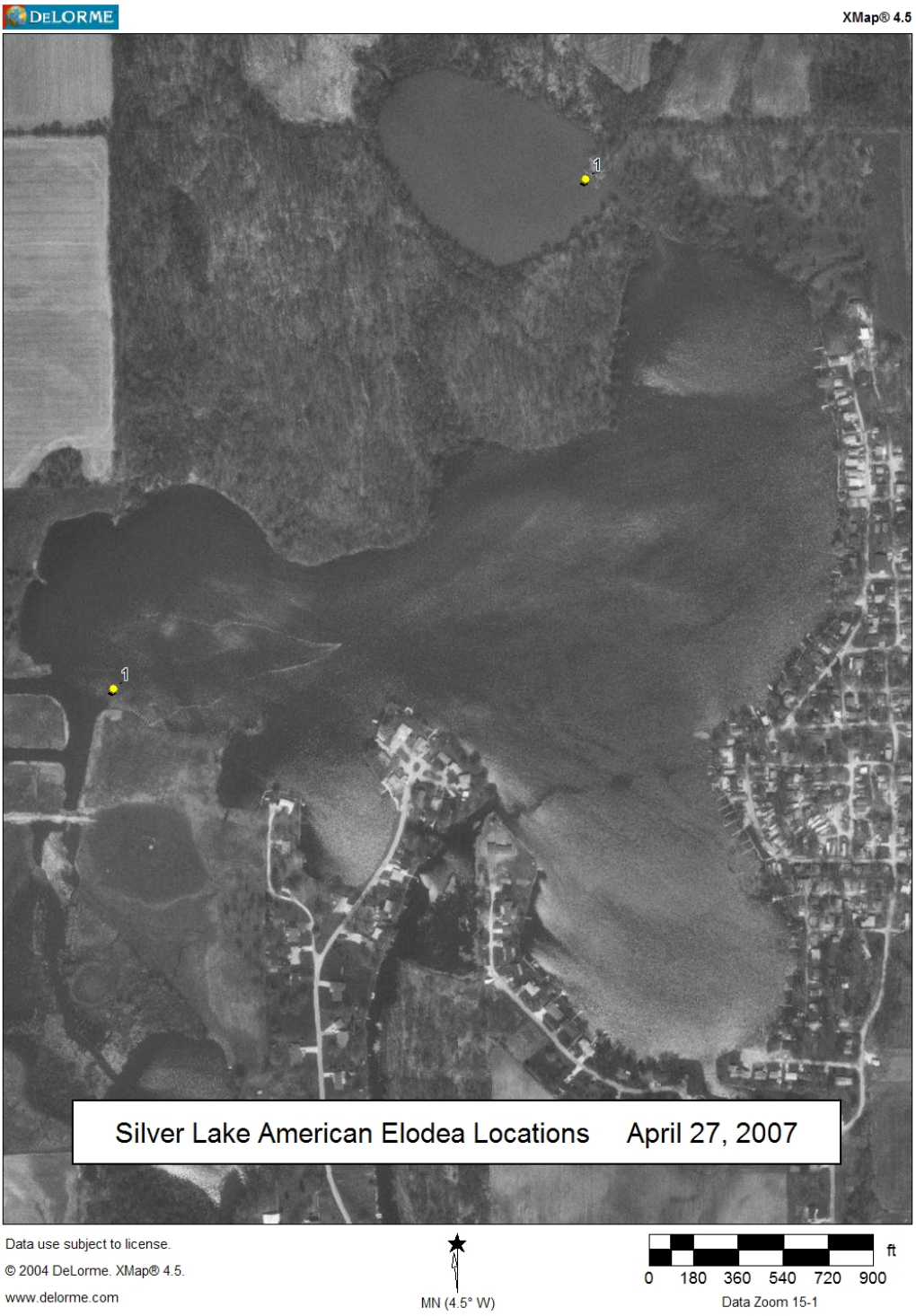


Figure 14: April 2007 Leafy Pondweed Locations

Figure 15: April 2007 Slender Naiad Locations

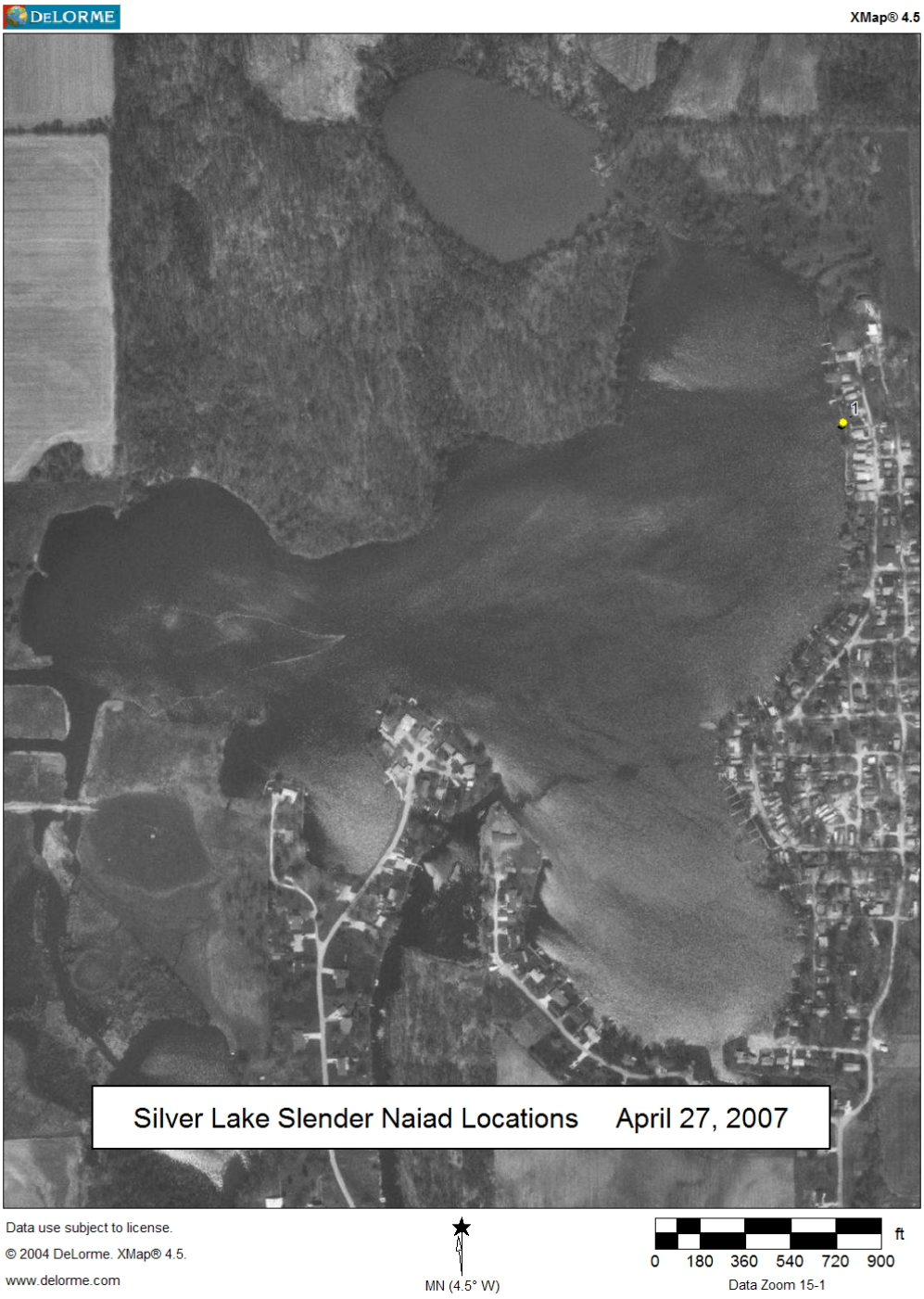


Figure 16: July 2007 Small Pondweed Locations

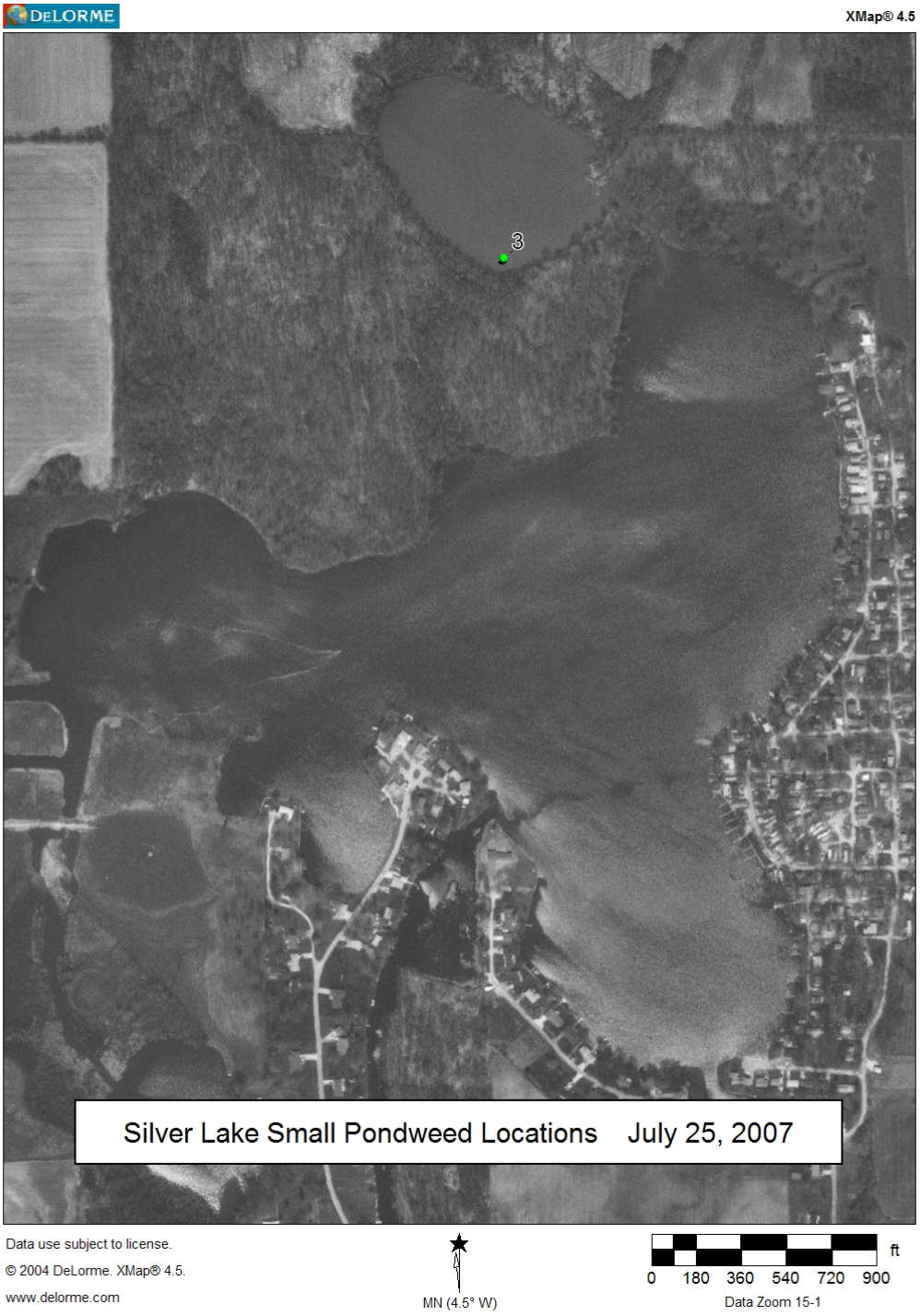


Figure 17: July 2007 Slender Naiad Locations

Figure 18: July 2007 Eurasian Watermilfoil Locations

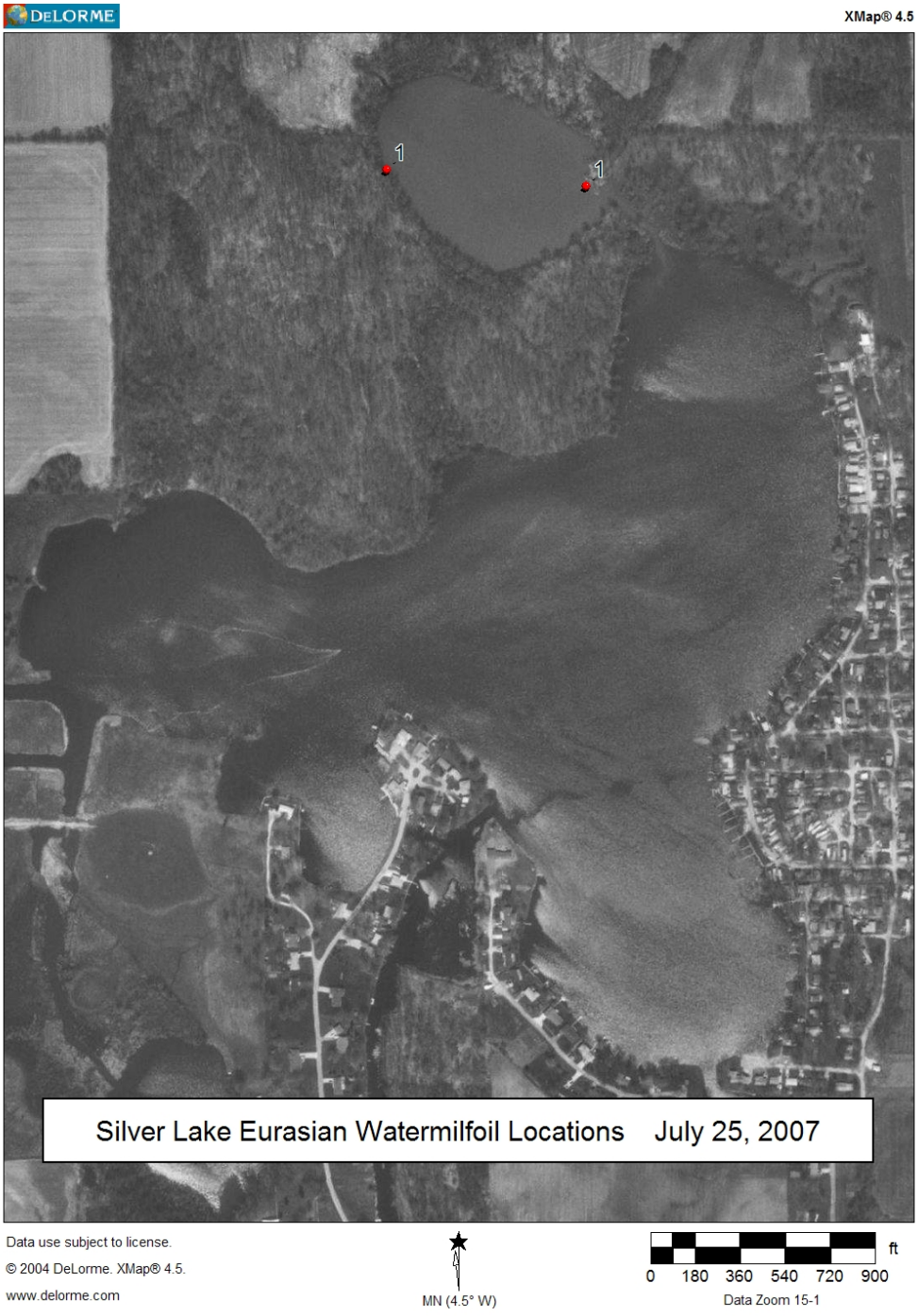


Figure 19: July 2007 Elodea Locations

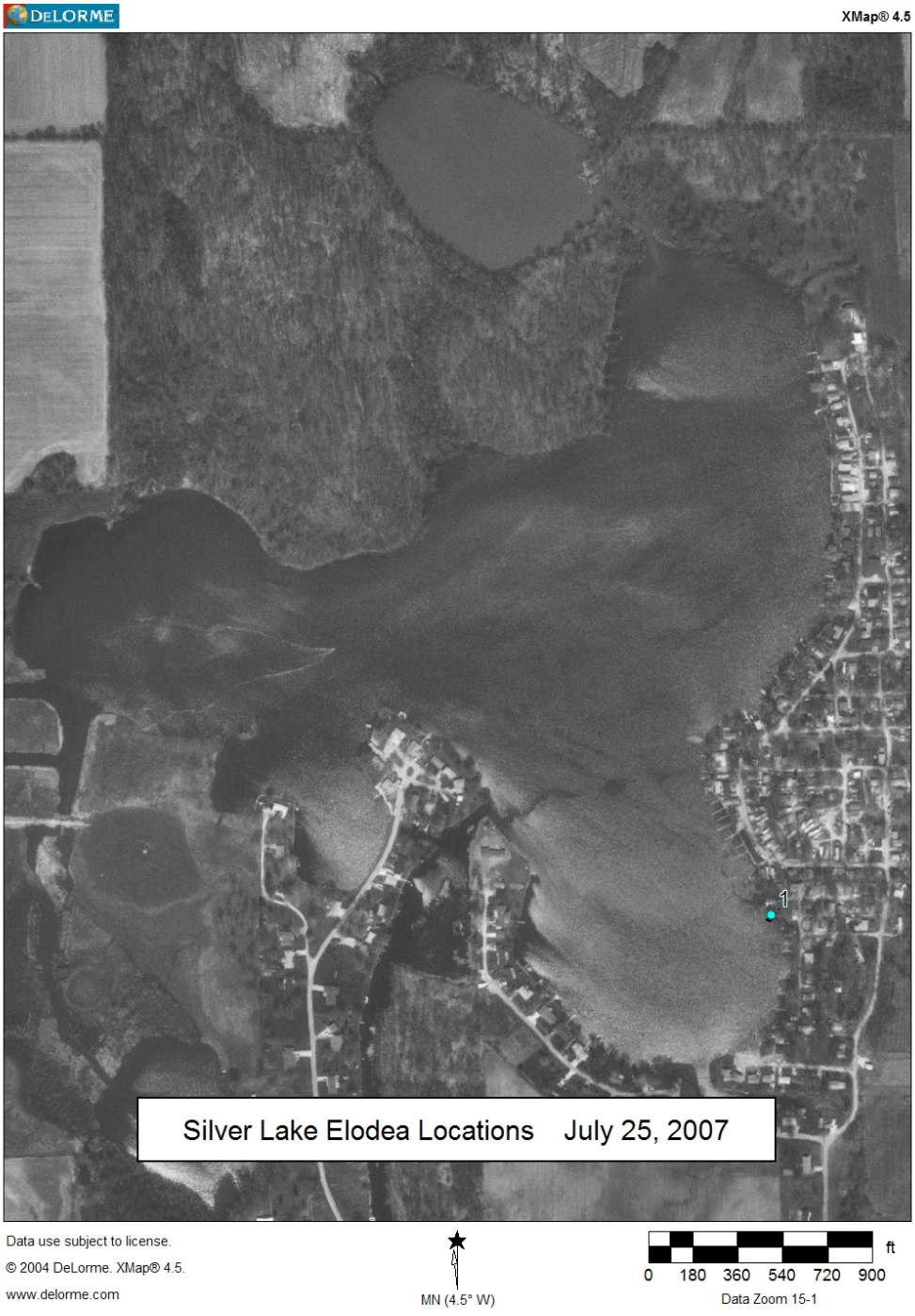


Figure 20: July 2007 Curly Leaf Pondweed Locations

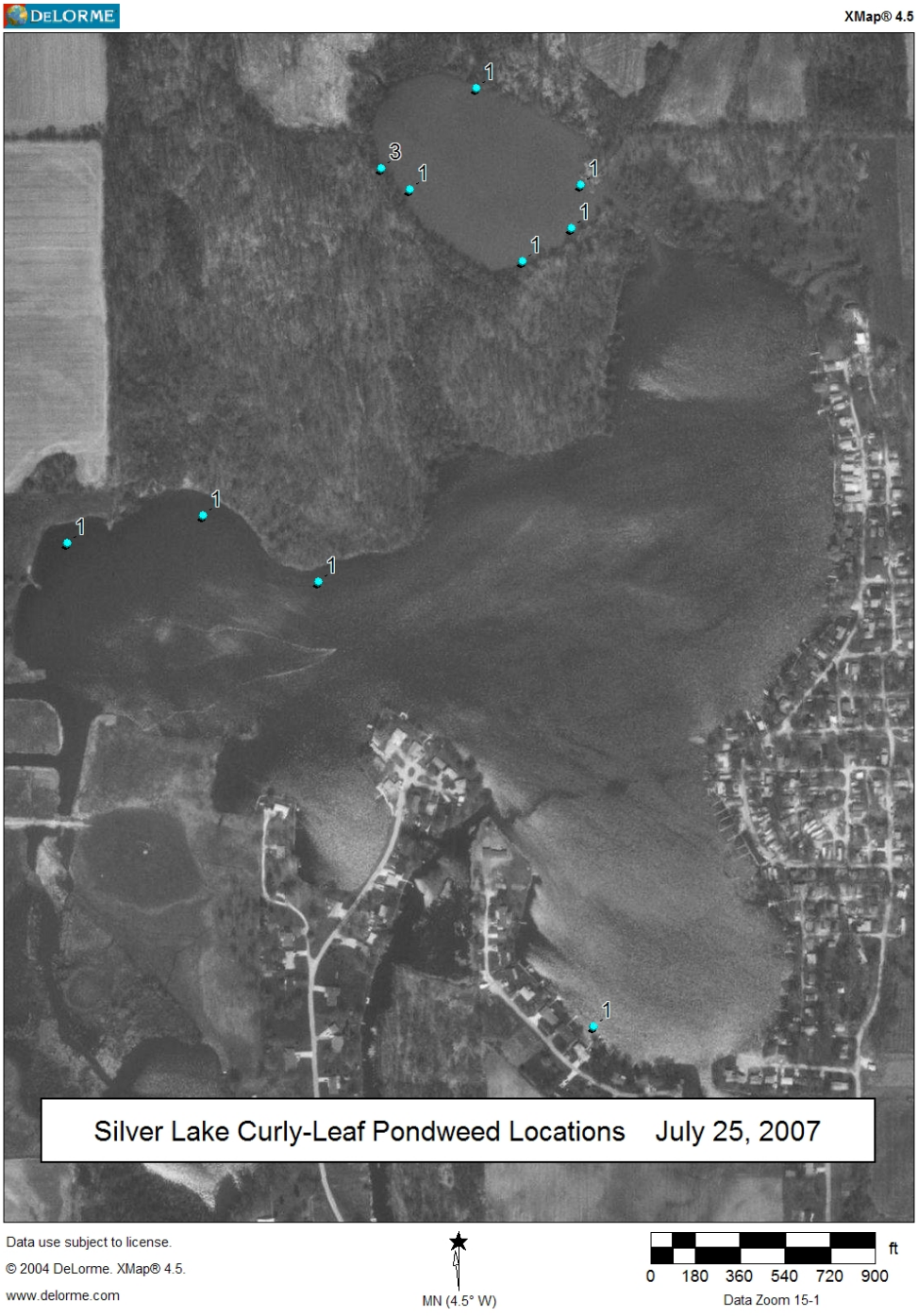
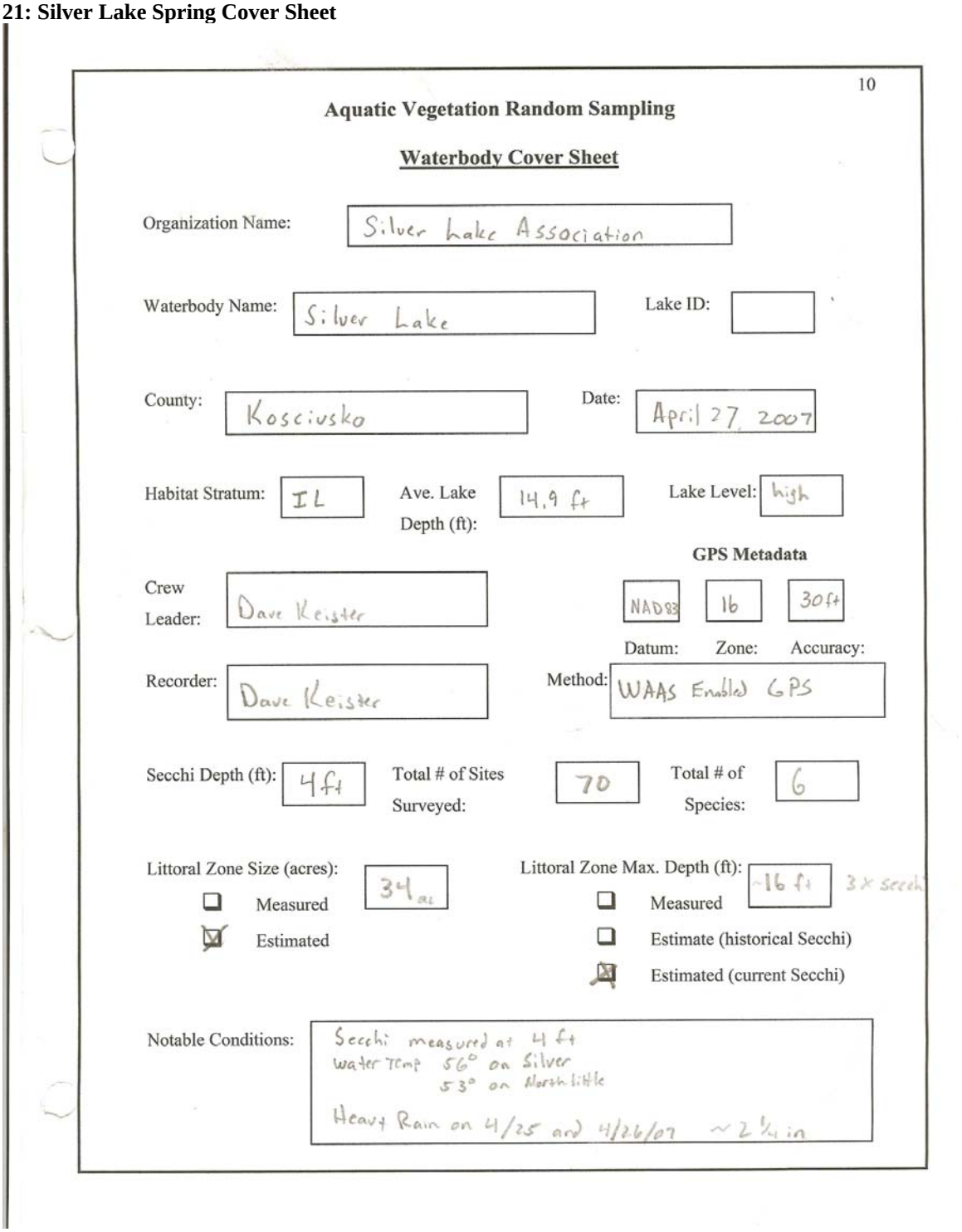


Figure 21: July 2007 Chara Locations

16.7 Data Sheets

Table 21: Silver Lake Spring Cover Sheet



10

Aquatic Vegetation Random Sampling

Waterbody Cover Sheet

Organization Name: Silver Lake Association

Waterbody Name: Silver Lake Lake ID:

County: Kosciusko Date: April 27, 2007

Habitat Stratum: IL Ave. Lake Depth (ft): 14.9 ft Lake Level: high

GPS Metadata

Crew Leader: Dave Keister NAD83 | 16 | 30ft

Datum: Zone: Accuracy:

Recorder: Dave Keister Method: WAAS Enabled GPS

Secchi Depth (ft): 4ft Total # of Sites Surveyed: 70 Total # of Species: 6

Littoral Zone Size (acres): 34 ac

☐ Measured

☒ Estimated

Littoral Zone Max. Depth (ft): ~16 ft 3x secchi

☐ Measured

☐ Estimate (historical Secchi)

☒ Estimated (current Secchi)

Notable Conditions: Secchi measured at 4 ft
Water Temp 56° on Silver
53° on North little
Heavy Rain on 4/25 and 4/26/07 ~2 ¼ in

Table 22: Silver Lake Spring Data Sheet 1

APPENDIX A

Submersed Aquatic Plant Survey Form

Page 1 of 3

WATER BODY NAME	Silver	Lake			SECCHI	4ft									
COUNTY	Kosciusko				MAX PLANT DEPTH	~9ft									
DATE	April 27, 2007				WEATHER	Temp 50° - overcast/some Rain / Water Temp 56°									
CREW LEADER	Dave				COMMENTS	Heavy Rain on 4/25 and 26 ~2½ in									
RECORDER	Dave														
					Rake score (1, 3, 5), observed only (9), algae present (p)										
					Use acronyms for species, V1, V2...for voucher codes										Note
					Coon Curly					Species Code					
Site	Latitude	Longitude	Depth	All	CEDE	PoCR3	Leer1	NAFL	MYSP2	Elodca					Algae
1	GPS	Way Points	3	2	2		1								P
2			12	0											P
3			9	0											P
4			3	4	4		1								P
5			9	0											P
6			2	2	2			1							P
7			8	3	3										P
8			4	4	4				1						P
9			9	1	1										P
10			4	5	5										P
11			7	0											P
12			15	0											-
13			3	4	4										P
14			5	0				1							P
15			4	5	5	1									P
16			2	4	3	1									P
17			3	5	5										P
18			5	5	5										P
19			2	5	5										P
20			3	5	5					1					P
21			4	3	3										P
22			3	5	5										P
23			2	4	4										P
24			2	4	4										P
25			5	2	2										P
26			3	1	1										P
27			5	1	1	1									P
28			4	2	2	1									P
29			2	2	2										P
30			2	2	2										P
31			9	0	0										P
32			15	0	0										-
Other plant species observed at lake															

Table 23: Silver Lake Spring Data Sheet 2

APPENDIX A

Submersed Aquatic Plant Survey Form

Page 2 of 3 11

WATER BODY NAME Silver Lake
COUNTY Kosciusko
DATE April 27, 2007
CREW LEADER Dave
RECORDER Dave

SECCHI 4ft
MAX PLANT DEPTH ~9 ft
WEATHER Temp 50° overcast / Some Rain / warmer Temp 56°
COMMENTS

Rake score (1, 3, 5), observed only (9), algae present (p)
Use acronyms for species, V1, V2...for voucher codes

Site	Latitude	Longitude	Depth	All	Species Code: CERFU	Note: Algae
33	GPS	Points	7	3	3	P
34	↓	↓	10	0		–
35			9	0		–
36			14	0		–
37			9	0		–
38			10	0		–
39			8	1	1	–
40			8	0		–
41			15	0		–
42			12	0		P
43			7	1	1	P
44			15	0		–
45			15	0		–
46			14	0		–
47			9	1	1	–
48			14	0		–
49			7	1	1	P
50			7	0	0	P

Other plant species observed at lake

Table 24: Silver Lake Spring Data Sheet 3

APPENDIX A

Submersed Aquatic Plant Survey Form

Page 3 of 3[11]

WATER BODY NAME North Little Lake					SECCHI 4ft										
COUNTY Kosciusko					MAX PLANT DEPTH ~ 10 ft										
DATE April 27, 2007					WEATHER Temp 50° overcast / Rain										
CREW LEADER Dave					COMMENTS Water Temp 53°										
RECORDER Dave															
					Rake score (1, 3, 5), observed only (9), algae present (p)										
					Use acronyms for species, V1, V2...for voucher codes										Note
					coon	curly	Eml		Species Code						
Site	Latitude	Longitude	Depth	All	CERdem	AlerP3	MISA	Elodea							Algae
1	GPS Points		4	1		1		1							
2			3	1	1										
3			5	1	1										
4			4	2	2										
5			5	1	1	1									
6			2	2	2										
7			3	1	1										
8			2	4	4	1									p
9			3	1	1										
10			3	2	1	1									
11			7	1	1										
12			8	1	1										
13			8	0											
14			9	0											
15			10	0											p
16			9	0											
17			10	1			1								
18			14	0											
19			13	0											
20			15	0											
Other plant species observed at lake															

Sample Site GPS coordinates

Table 25: Sample Location Coordinates

Site	Latitude	Longitude
1	41.08021	-85.8991
2	41.08073	-85.8986
3	41.08129	-85.8977
4	41.08243	-85.8974
5	41.082	-85.8973
6	41.08339	-85.8973
7	41.08412	-85.8978
8	41.08478	-85.8981
9	41.08492	-85.8994
10	41.08423	-85.8999
11	41.08394	-85.9003
12	41.08345	-85.9003
13	41.08319	-85.9012
14	41.08306	-85.9021
15	41.08237	-85.9031
16	41.08178	-85.9047
17	41.0825	-85.9064
18	41.0822	-85.9083
19	41.08127	-85.9087
20	41.08054	-85.9077
21	41.08025	-85.9064
22	41.0799	-85.905
23	41.07898	-85.9045
24	41.08053	-85.9037
25	41.07972	-85.9023
26	41.07826	-85.9016
27	41.07691	-85.9007
28	41.07683	-85.8988
29	41.07762	-85.8979
30	41.07866	-85.8984
31	41.07974	-85.8993
32	41.08285	-85.9015
33	41.08204	-85.9033
34	41.08164	-85.9039
35	41.08182	-85.9059
36	41.08147	-85.9066
37	41.08175	-85.9079
38	41.08067	-85.9072
39	41.08074	-85.9053
40	41.08103	-85.9044
41	41.08057	-85.9029
42	41.07975	-85.9018
43	41.07912	-85.9018
44	41.07818	-85.9011
45	41.07755	-85.9014
46	41.07744	-85.9004

47	41.07666	-85.8998
48	41.07723	-85.8994
49	41.07812	-85.8981
50	41.07927	-85.899
51	41.08612	-85.9009
52	41.08676	-85.9013
53	41.08699	-85.902
54	41.0872	-85.9026
55	41.08715	-85.9037
56	41.0863	-85.9038
57	41.08571	-85.9034
58	41.08513	-85.9026
59	41.08528	-85.9017
60	41.08564	-85.901
61	41.08602	-85.901
62	41.08665	-85.9011
63	41.08717	-85.9024
64	41.08607	-85.9034
65	41.08593	-85.9033
66	41.08533	-85.9021
67	41.08577	-85.9011
68	41.08674	-85.9016
69	41.08693	-85.9035
70	41.08604	-85.9033

16.8 IDNR Aquatic Vegetation Control Permit

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004
[X] Whole Lake [ ] Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to: Page 1 of ___
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name	Lake Assoc. Name	
Jim Walker	Silver Lake Conservation Association Inc,	
Rural Route or Street		Phone Number
3332 West Neher Road		260-352-0806
City and State		ZIP Code
Silver Lake IN		46982
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County
Silver Lake	Silver Lake	Kosciusko
Does water flow into a water supply	[ ] Yes	[X] No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1	LAT/LONG or UTM's Entire perimeter of Lake		
Total acres to be controlled 29.39	Proposed shoreline treatment length (ft) 10,244	Perpendicular distance from shoreline (ft) 125	
Maximum Depth of Treatment (ft) 5	Expected date(s) of treatment(s) Late March early April		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Aquathal K

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) _____

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	20
Curley Leaf	X	60
Coontail		20

Page ____ of ____

Treatment Area #	LAT/LONG or UTM's	
Total acres to be controlled	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s)	

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. _____

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) _____

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

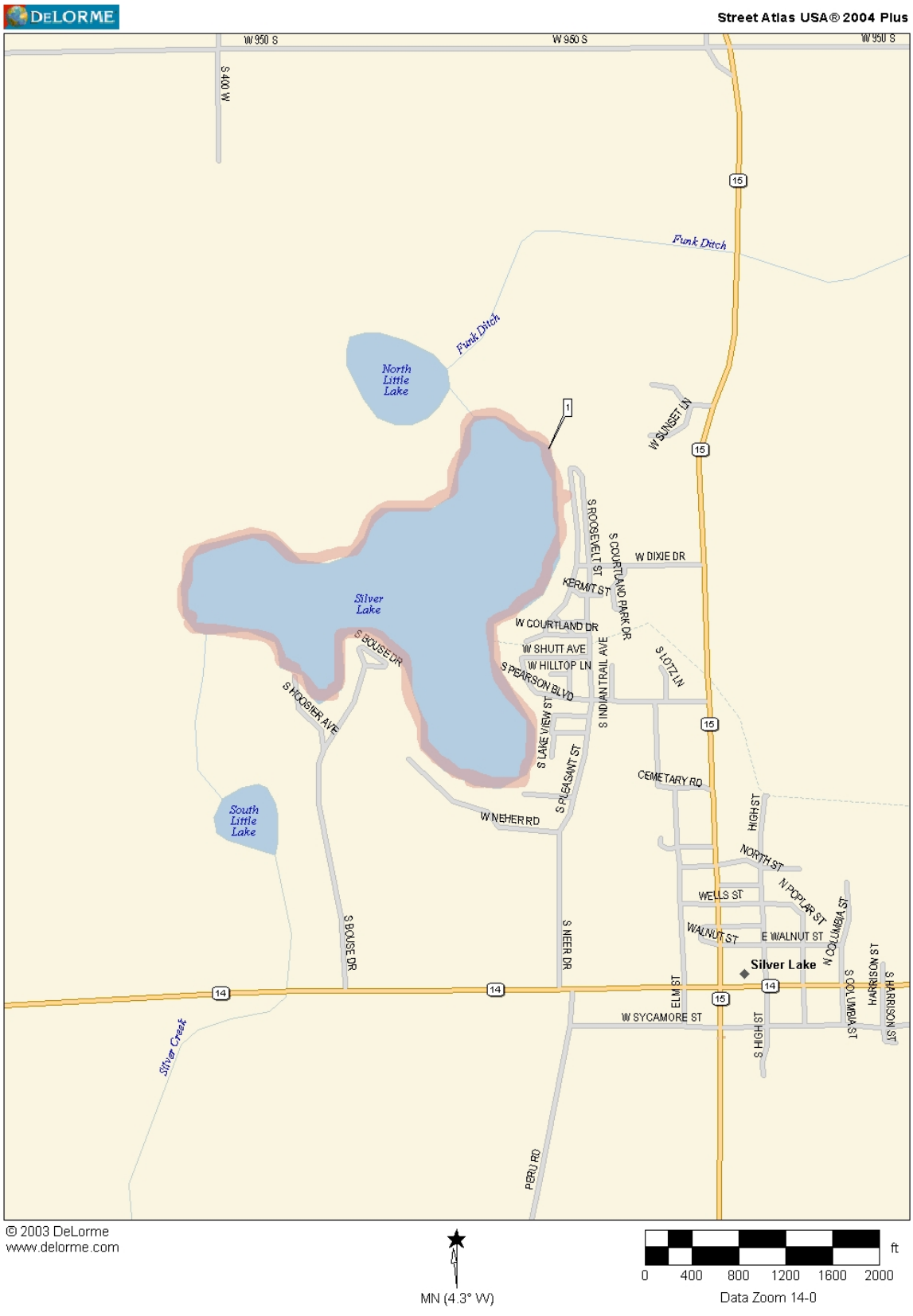
Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

☐ Approved ☐ Disapproved	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204


DeLORME
Street Atlas USA® 2004 Plus
W 950 S
S 400 W
Funk Ditch
North Little Lake
Silver Lake
South Little Lake
W SUNSET LN
S ROOSEVELT ST
S COURTLAND PARK DR
W DIXIE DR
KERMIT ST
W COURTLAND DR
W SHUTT AVE
W HILLTOP LN
S PEARSON BLVD
S INDIANTRAIL AVE
S LOTZ LN
S LAKE VIEW ST
S PLEASANT ST
S BOUSE DR
S HOOSIER AVE
W NEHER RD
CEMETARY RD
HIGH ST
NORTH ST
WELLS ST
N POPLAR ST
WALNUT ST
E WALNUT ST
N COLUMBIA ST
Silver Lake
S NEER DR
ELM ST
W SYCAMORE ST
S HIGH ST
S COLUMBIA ST
S HARRISON ST
Silver Creek
PERU RD
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MN (4.3° W)
0 400 800 1200 1600 2000 ft
Data Zoom 14-0